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F3A

(54) Pyrotechnic device

(57) The pyrotechnic device has a cylindrical casing 34 having a nozzle 35 or row of nozzles in a part of the cylindrical wall of the casing, and a weight 30 located adjacent a diametrically opposite part of the casing wall to orientate the device during flight and increase the likelihood of its landing or coming to rest with the nozzle or nozzles uppermost. The casing contains one or more charges 38 of combustible material adapted to emit a stream of combustion products, e.g. hot particles and smoke, through the nozzle or nozzles, in particular both during flight and after landing.

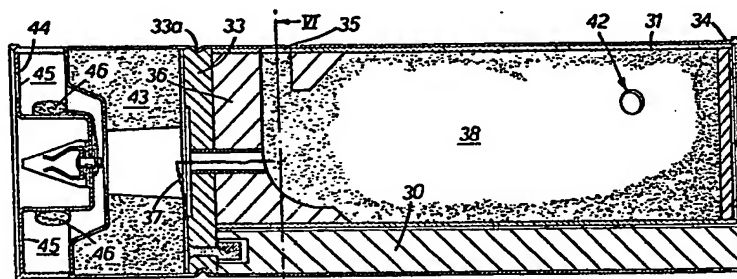


Fig. 5.

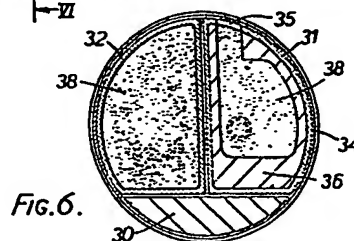
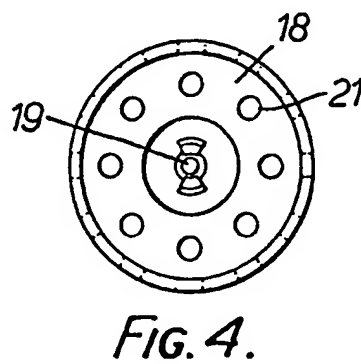
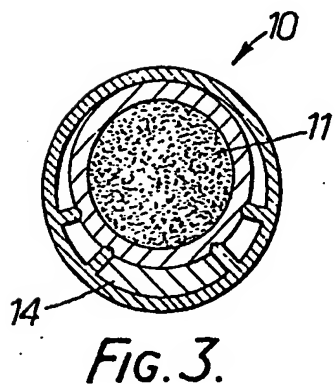
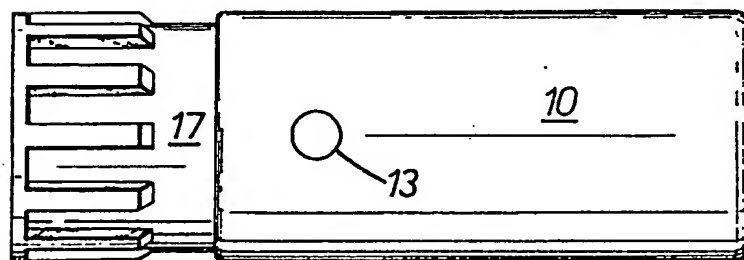
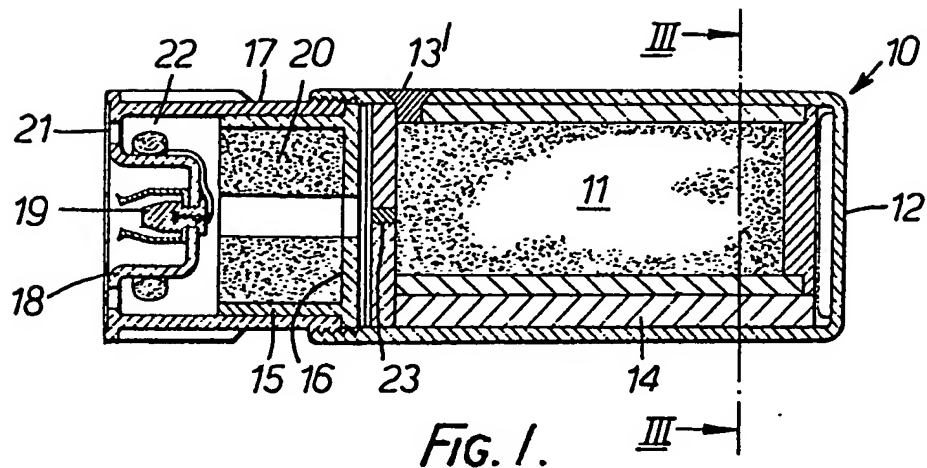


Fig. 6.

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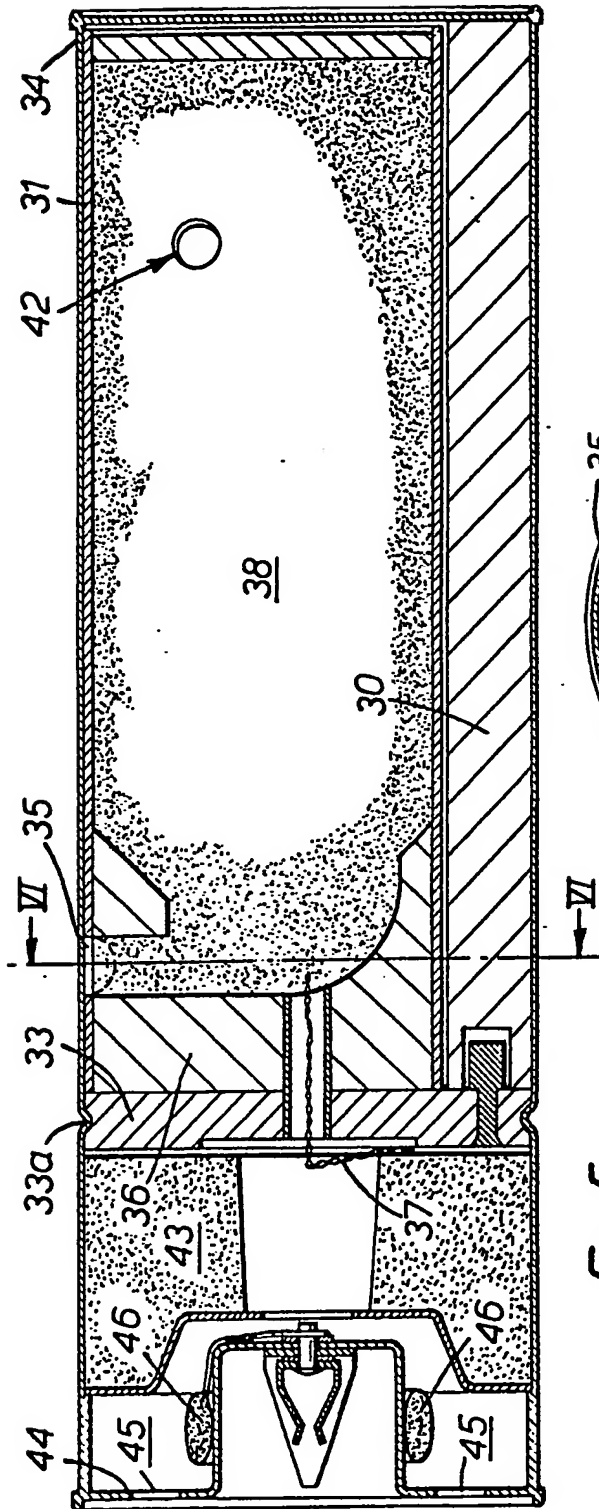


FIG. 5.

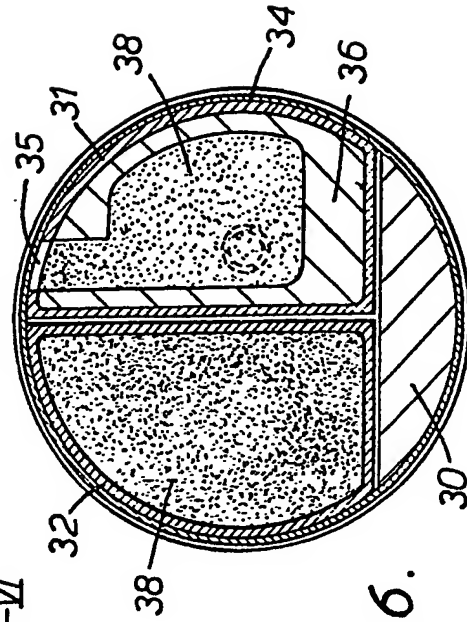


FIG. 6.

SPECIFICATION

Pyrotechnic device

5 This invention relates to a pyrotechnic device, and in particular to a device which after being thrown or otherwise projected, will land and assume a preferred orientation.

Such a device is useful when containing one or more charges of combustible material and it is desirable that the combustion products be ejected from the device in a preferred direction or in a number of preferred or desired directions.

According to the present invention, there is provided a pyrotechnic device comprising a container, one or more charges of combustible material within the container, one or more discharge apertures in the container through which the combustion products results from combustion of said material can be expelled, and a weight so disposed within the container as to predispose the container to land, or to come to rest after landing, with the aperture or apertures orientated in a preferred direction.

Forms of pyrotechnic device in accordance with the invention are illustrated in the accompanying drawings in which:

Figure 1 is an axial section through a pyrotechnic device in accordance with the invention and having a cylindrical container;

Figure 2 is a plan view of the pyrotechnic device of *Figure 1*;

Figure 3 is a section on the line III-III of *Figure 1*;

Figure 4 is an end elevation of the pyrotechnic device of *Figures 1* and *2*;

Figure 5 is a cross-section through a second form of pyrotechnic device according to the invention; and

Figure 6 is a cross-section on the line VI-VI of *Figure 5*.

The pyrotechnic device as shown in *Figures 1* to *4* comprises a first cylindrical container 10 for containing a charge 11 of combustible material, the container having an integral end wall 12, the opposite end of the container being closed by a closure fitted therewithin.

An exit nozzle or other aperture 13 is provided in the cylindrical wall of the container 10 through which the products of combustion of the combustion charge can be expelled. If more than one such aperture is provided, the apertures will preferably be arranged in a single row or in two or more rows parallel to the axis of the cylindrical container.

A weight 14 is mounted on or adjacent the inside of the container in a position opposite the exit nozzle or the row of exit nozzles. Conveniently this weight extends over substantially the whole length of the cylindrical container and round a fraction, for example one quarter, of the internal circumference of the container.

As a result of this construction, as the pyrotechnic device is thrown or projected through the air, the eccentrically located weight 14 will assist in orientating the device with the exit nozzle or nozzles

13 uppermost. Moreover, if the combustible charge 11 within the container is ignited before or during its flight, the expulsion of combustion products through the nozzle or nozzles will apply a reaction to the container along a line which will tend to assist the weight in orientating the device to direct the exit nozzles upwardly.

Accordingly, when the device lands, it will normally land with the weight downmost and the exit nozzle or nozzles upmost. If the ground on which it lands is soft, there is a high probability that it will remain in this orientation and allow the combustion products to continue to be expelled from the exit nozzle in an upward direction. On the other hand, if the device falls on a hard surface along which it can roll, it will most likely come to rest with the weight downmost and the nozzle uppermost.

In the particular embodiment of the pyrotechnic device illustrated in *Figures 1* to *4*, a second cylindrical container 15 is provided which is closed at one end by an integral wall 16 but is open at its opposite end, the closed end of the second container being fitted within the mouth of the first container 10. A third cylindrical container 17 which is closed at one end by an end wall 18 is fitted as a sleeve over the second cylindrical container 15 and between the cylindrical wall of the first and second containers 10, 15.

The second container contains a second charge 20 of combustible material, and the end wall 18 of the third container 17 is provided with apertures 21 through which the combustion products of the second combustible charge 20 will be expelled.

Conveniently, the exit nozzles or apertures 13, 21 of the first container and of the second container will be closed initially by easily frangible or combustible plugs such as 13' which will be consumed or ejected upon ignition of the combustible charges.

The third container can contain an ejection charge 22 capable, upon ignition for example by an electrically-fired igniter 19 fitted in wall 18, of expelling the plugs of the apertures in the wall 18 and also igniting the charge 20 in the second container.

The charge 20 in the second container preferably has a central open core through which a flame can be propagated to an opening in the end wall 16 of the second container to allow the flame to be transmitted into the first container and ignite an igniter 23 by means of which the charge 11 of the first container will be ignited and will commence to burn while the device is in flight.

The combustible charge 11 in the first container can be formulated for producing a screen of hot particles whereas the combustible charge in the second container is for producing a smoke screen. However, other types of combustible charge can be contained in the first and second containers.

It has been found that although the charge 11 in the first container is cylindrical and burns in an axial direction, the location of the exit nozzle in the cylindrical wall of the container is no disadvantage, although it is a departure from the normal axial

outlet for the combustion products of a rocket-type charge.

In a modification of the embodiment described above, voids or areas of lower density than the combustible charge may be suitably located within the casing so that the combustible charge itself constitutes an eccentric weight. In this event the need for an eccentric weight of non-combustible material is reduced or possibly eliminated, as well as reducing the overall weight of the device.

Moreover, an extra-fast burning composition can be located in the discharge nozzles to produce a reaction at the commencement of combustion such as to re-orientate a device which had failed to land with the discharge nozzles uppermost.

Again, instead of locating one or more nozzles immediately opposite the eccentric weight, a number of off-centre nozzles may be provided which are preferably disposed in a balanced array.

In order to assist the effect of the eccentric weight, one or more fins or shaped protrusions may be provided on the outside of the casing to assist in righting the device prior to, or subsequent to, landing.

In a second form of the invention illustrated in Figures 5 and 6, the pyrotechnic device is formed of three main components, namely an elongate weight 30 whose cross-section is shaped as a minor segment of a circle, and two containers 31, 32 of equal dimensions which, when fitted together with the weight 30, form a cylinder whose radius is equal to that of the above-mentioned segment. The three components are fitted at one end thereof to a disc-shaped supporting wall 33 to form an assembly which is further held together by fitting the assembly into a sheet metal can 34. The disc-shaped wall is formed with a peripheral recess 33a and the surrounding wall of the can is crimped into the recess to secure the parts together.

Each of the containers is designed to contain a charge of combustible material, and has an outlet aperture at one end to which combustion products are guided by a shaped insert in the end portion of the container adjacent the outlet aperture.

The container 31 has its outlet aperture 35 located adjacent the disc-shaped wall 33 and an igniter 37 extends through the disc and through the shaped insert 36 to ignite the combustible material 38 within the container adjacent the outlet aperture.

The other container 32, being identical with the container 31, has its outlet aperture (not shown) and insert (not shown) at the end remote from the disc, and an ignition transfer tube 42 extends between the two containers 31, 32 adjacent the outlet end of container 32 to ignite combustible material in container 32. By these means, even burning of the combustible material over a prolonged period can be achieved.

In a manner similar to that of the first embodiment, the can 34 is extended beyond the disc-shaped wall 33 and contains a second charge of combustible material 43, the forward end of the can being closed by an end wall 44. The end wall is formed with outlet apertures or outlet passage-

ways 45 through which the combustion products of the second charge can be discharged. The second charge 43 preferably has a central open core through which a flame can be propagated to ignite the igniter 37. The first and second charges can have the same compositions as in the first-described embodiment.

An ejection charge 46 is disposed adjacent the end wall 44 and is effective when ignited to discharge a propellant stream of gases through the apertures or passageways 45 to launch the device from a suitable launcher. Ignition of charge 46 will, in turn, ignite charge 43 and igniter 37.

The provision of an eccentric weight in the device can cause an undesirable deflection in the flight path of the device. This can be obviated by arranging for the device to be projected with the location of the weight in a predetermined orientation so that the deflection is predetermined. Other ways of overcoming the problem include fitting a drogue to the device, fitting a compensating fin or tail, or a gyroscopic device, causing the device to spin, or providing a nozzle for the ejection of combustion products in a position on the device adapted to compensate for the deflection.

CLAIMS

1. A pyrotechnic device comprising a container, one or more charges of combustible material within the container, one or more discharge apertures in the container through which the combustion products resulting from combustion of said material can be expelled, and a weight so disposed within the container as to predispose the container to land, or to come to rest after landing, with the aperture or apertures orientated in a preferred direction.

2. A pyrotechnic device according to claim 1 wherein the container has a cylindrical wall in which said apertures are provided.

3. A pyrotechnic device comprising a container having a cylindrical wall, one or more charges of combustible material within the container, one or more discharge apertures in said wall of the container through which the combustion products resulting from combustion of said material can be expelled, and a weight disposed eccentrically within the container and adjacent a part of said wall of the container which is remote from said one or more apertures.

4. A pyrotechnic device according to any preceding claim wherein a second container connected to the first container contains a further charge of combustible material, the second container having one or more apertures through which the combustion products of said further charge can be expelled.

5. A pyrotechnic device according to claim 4 wherein the first-mentioned container contains combustible material adapted to produce a screen of hot particles, and the second container contains a smoke-producing combustible material.

6. A pyrotechnic device according to claim 4 or claim 5 wherein an igniter located adjacent the

junction of the two containers is effective to allow combustion of the material in one container to ignite the material in the other container.

7. A pyrotechnic device according to claim 5 wherein said container flow guide means for guiding the flow of hot particles along a curved path to the or each discharge aperture.

8. A pyrotechnic device according to any preceding claim having igniting means operable to cause combustion of the combustible material while the device is in flight.

9. A pyrotechnic device according to any of one of claims 1 to 3 wherein the weight is shaped in cross-section as a segment of a circle, and the container is formed in two substantially identical parts, said parts and said weight together forming a right cylinder.

10. A pyrotechnic device substantially as herein described with reference to any one of the embodiments illustrated in the accompanying drawings.

Superseded claims 1-10

New or amended claims:- 1-9

1. A pyrotechnic device comprising a container having a cylindrical wall and end walls at opposite ends of said cylindrical wall, at least one charge of combustible material within the container, the container having at least one discharge aperture in said cylindrical wall through which the combustion products resulting from combustion of said material can be expelled, and a weight so disposed in a fixed position within the container as to predispose the container to come to rest after landing on a hard surface with the cylindrical wall in contact with said surface and with the aperture orientated in a preferred direction.

2. A pyrotechnic device comprising a container having a cylindrical wall, at least one charge of combustible material within the container, said wall of the container having at least one discharge aperture therein through which the combustion products resulting from combustion of said material can be expelled, and a weight disposed eccentrically within the container and adjacent a part of said wall of the container which is circumferentially remote from said aperture.

3. A pyrotechnic device according to claim 2 wherein a second container connected to the first-mentioned container contains a further charge of combustible material, the second container having at least one aperture through which combustion products resulting from combustion of said further charge can be expelled.

4. A pyrotechnic device according to claim 3 wherein the first-mentioned container contains combustible material adapted to produce a screen of hot particles, and the second container contains a smoke-producing combustible material.

5. A pyrotechnic device according to claim 3 wherein an igniter located adjacent the junction of the two containers is effective to allow combustion of the material in one container to ignite the material in the other container.

6. A pyrotechnic device according to claim 4

wherein said container contains flow guide means for guiding the flow of hot particles along a curved path to the discharge aperture.

7. A pyrotechnic device according to claim 1 having igniting means operable to cause combustion of the combustible material while the device is in flight.

8. A pyrotechnic device according to claim 2 wherein the weight is shaped in cross-section as a segment of a circle, and said one charge of combustible material is formed in two substantially identical parts, each housed in part-cylindrical containers, said part cylindrical containers and said weight together forming a right cylinder fitting closely within said cylindrical wall.

9. A pyrotechnic device substantially as herein described with reference to any one of the embodiments illustrated in the accompanying drawings.

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